R08 020925 682

September 25, 2002

U.S. Nuclear Regulatory Commission
ATTN: Document Control Desk
Mail Stop OWFN, P1-35
Washington, D. C. 20555-0001

10 CFR 50.73

Dear Sir:

TENNESSEE VALLEY AUTHORITY - BROWNS FERRY NUCLEAR PLANT (BFN) - UNIT 2 - DOCKET 50-260 - FACILITY OPERATING LICENSE DPR-52 - LICENSEE EVENT REPORT (LER) 50-260/2002-002-00

The enclosed report provides details of an automatic scram which occurred on Unit 2. A fault in a main bank transformer bushing caused a main generator trip which directly resulted in the scram.

In accordance with 10 CFR 50.73(a)(2)(iv)(A), TVA is reporting this event as the valid actuation of the reactor protection system and of containment isolation valves in more than one system. There are no commitments contained in this letter.

Sincerely,

original signed by R. G. Jones for:

Ashok S. Bhatnagar

cc: See page 2

Enclosure
cc (Enclosure):
(Via NRC Electronic Distribution)
Mr. Kahtan N. Jabbour, Project Manager
U.S. Nuclear Regulatory Commission
(MS 08G9)
One White Flint, North
11555 Rockville Pike
Rockville, Maryland 20852-2739

Mr. Paul E. Fredrickson, Branch Chief
U.S. Nuclear Regulatory Commission
Region II
Sam Nunn Atlanta Federal Center
61 Forsyth Street, SW, Suite 23T85
Atlanta, Georgia 30303-8931

NRC Resident Inspector
Browns Ferry Nuclear Plant
P. O. Box 149
Athens, Alabama 35611

TEA:DTL:PSH:BAB
Enclosure
cc (Enclosure):
A. S. Bhatnagar, PAB 1B-BFN
M. J. Burzynski, BR 4X-C
R. G. Jones, POB 2C-BFN
J. Scott Martin, PMB 1A-BFN
F. C. Mashburn, BR 4X-C
D. C. Olesvary, LP 6A-C
C. L. Root, PAB 1G-BFN
J. R. Rupert, LP 6A-C
T. L. Shults, PEC 2B-BFN
K. W. Singer, LP 6A-C
E. J. Vigluicci, ET 11A-K
R. E. Wiggall, PEC 2A-BFN
LEREvents@inpo.org
NSRB Support, LP 5M-C
EDMS-K

s:lic/submit/lers/260-2002-002.doc

NRC FORM 366 (7-2001) U.S. NUCLEAR REGULATORY COMMISSION

APPROVED BY OMB NO. 3150-0104 EXPIRES 7-31-2004

Estimated burden per response to comply with this mandatory information collection request: 50 hours. Reported lessons learned are incorporated into the licensing process and fed back to industry. Send comments regarding burden estimate to the Records Management Branch (T-6 E6), U.S. Nuclear Regulatory Commission, Washington, DC 20555-0001, or by Internet e-mail to bjs1@nrc.gov, and to the Desk Officer, Office of Information and Regulatory Affairs, NEOB-10202 (3150-0104), Office of Management and Budget, Washington, DC 20503. If a means used to impose information collection does not display a currently valid OMB control number, the NRC may not conduct or sponsor, and a person is not required to respond to, the information collection.

LICENSEE EVENT REPORT (LER)

(See reverse for required number of digits/characters for each block)

1. FACILITY NAME	2. DOCKET NUMBER	3. PAGE
Browns Ferry Nuclear Plant Unit 2	05000260	1 OF 6

4. TITLE
Automatic Scram resulting from Main Bank Transformer bushing fault

5. EVENT DATE			6. LER NUMBER			7. REPORT DATE			8. OTHER FACILITIES INVOLVED	
MO	DAY	YEAR	YEAR	SEQUENTIAL NUMBER	REV NO	MO	DAY	YEAR	FACILITY NAME	DOCKET NUMBER
									None	N/A
07	27	2002	2002	- 002	- 00	09	25	2002	FACILITY NAME None	DOCKET NUMBER N/A

9. OPERATING MODE	1
10. POWER LEVEL	100

11. THIS REPORT IS SUBMITTED PURSUANT TO THE REQUIREMENTS OF 10 CFR §: (Check all that apply)

20.2201(b)	20.2203(a)(3)(ii)	50.73(a)(2)(ii)(B)	50.73(a)(2)(ix)(A)
20.2201(d)	20.2203(a)(4)	50.73(a)(2)(iii)	50.73(a)(2)(x)
20.2203(a)(1)	50.36(c)(1)(i)(A)	X 50.73(a)(2)(iv)(A)	73.71(a)(4)
20.2203(a)(2)(i)	50.36(c)(1)(ii)(A)	50.73(a)(2)(v)(A)	73.71(a)(5)
20.2203(a)(2)(ii)	50.36(c)(2)	50.73(a)(2)(v)(B)	OTHER
20.2203(a)(2)(iii)	50.46(a)(3)(ii)	50.73(a)(2)(v)(C)	specify in Abstract below or in
20.2203(a)(2)(iv)	50.73(a)(2)(i)(A)	50.73(a)(2)(v)(D)	NRC Form 366A
20.2203(a)(2)(v)	50.73(a)(2)(i)(B)	50.73(a)(2)(vii)	
20.2203(a)(2)(vi)	50.73(a)(2)(i)(C)	50.73(a)(2)(viii)(A)	
20.2203(a)(3)(i)	50.73(a)(2)(ii)(A)	50.73(a)(2)(viii)(B)	

12. LICENSEE CONTACT FOR THIS LER

NAME	TELEPHONE NUMBER (Include Area Code)
Paul S. Heck, Nuclear Engineer, Licensing and Industry Affairs	256-729-3624

13. COMPLETE ONE LINE FOR EACH COMPONENT FAILURE DESCRIBED IN THIS REPORT

CAUSE	SYSTEM	COMPONENT	MANU-FACTURER	REPORTABLE TO EPIX		CAUSE	SYSTEM	COMPONENT	MANU-FACTURER	REPORTABLE TO EPIX
X	EL	INS	A500	Yes						

14. SUPPLEMENTAL REPORT EXPECTED			15. EXPECTED SUBMISSION DATE	MONTH	DAY	YEAR
YES (If yes, complete EXPECTED SUBMISSION DATE)	X	NO				

16. ABSTRACT (Limit to 1400 spaces, i.e., approximately 15 single-spaced typewritten lines)

On July 27, 2002, a Unit 2 main generator trip, main turbine trip, and reactor scram occurred from 100% power. All expected system responses were received, including the automatic opening of four safety-relief valves. Actuation of primary containment isolation system groups 2, 3, 6, and 8 occurred due to the expected temporary lowering of reactor water level. This logic isolates shutdown cooling (if in service), isolates the reactor water cleanup system, isolates the normal reactor building ventilation, initiates the standby gas treatment and the control room emergency ventilation systems, and retracts traversing incore probes (if inserted). The normal heat rejection path for the reactor remained in service. Reactor water level was recovered to the normal operating range by the normal reactor water level control system. Neither the high pressure coolant injection nor reactor core isolation cooling systems were used during this event.

The generator tripped due to a ground fault on a main bank transformer bushing, which occurred due to thermal degradation of the paper insulation of the bushing's internal condenser. Corrective actions included replacement of all of the low-side bushings on the transformer and increased monitoring of generator neutral resistor voltage trends. All new bushings will be installed on Unit 2 and Unit 3 main bank transformers. TVA will re-evaluate the criteria used in determining bushing condenser replacement intervals, and the bushing maintenance practices will be revised accordingly.

I. PLANT CONDITION(S)

Prior to the reactor scram event, Unit 2 was in Mode 1 at 100 percent reactor power (approximately 3458 megawatts thermal). Unit 3 was in Mode 1 at 100 percent reactor power (approximately 3458 megawatts thermal). Unit 1 was shutdown and defueled. Units 1 and 3 were unaffected by the event.

II. DESCRIPTION OF EVENT

A. Event:

On Saturday, July 27, 2002, while in steady state operation at 100% power, a main generator [TB] trip, main turbine [TA] trip, and reactor scram occurred at 12:28 PM. All expected system responses were received, including the automatic opening of four safety-relief valves (SRV) [SB] upon the initial reactor pressurization transient. Actuation of primary containment isolation system (PCIS) [JM] groups 2, 3, 6, and 8 occurred due to the expected temporary lowering of reactor water level below the actuation setpoint. This logic isolates shutdown cooling [BO] (if in service), isolates the reactor water cleanup (RWCU) [CE] system, isolates the normal reactor building ventilation [VA], initiates the standby gas treatment (SGT) [BH] system, initiates the control room emergency ventilation (CREV) [VI] system, and retracts Traversing Incore Probes [IG] (if inserted). The normal heat rejection path (from the reactor to the main condenser via the steam lines with reactor water make-up provided by the condensate/feedwater system[SD/SJ]) remained in service. Reactor water level was recovered to the normal operating range by the normal reactor water level control system. Neither the high pressure coolant injection (HPCI) [BJ] nor reactor core isolation cooling (RCIC) [BN] systems were used during this event. Reactor water level did not drop to the auto-initiation point for these systems, and they were not manually placed in service by the control room staff.

It was subsequently determined that a fault had occurred in a low-side bushing on main bank transformer 2A [EL]. The main generator ground fault protection circuitry detected this condition and initiated the generator and main turbine trips. The main turbine trip directly actuated the reactor protection system (RPS) [JC] to accomplish the scram, since the unit was operating at a power level greater than the bypass point for this scram signal. Following substitution of a spare main transformer in place of the original 2A transformer, Unit 2 was restarted.

Because this event involved the valid, automatic actuation of the RPS and the operation of containment isolation valves in more than one system, and because the scram was not part of a pre-planned sequence, this event is reportable in accordance with 10 CFR 50.73 (a) (2) (iv) (A).

B. Inoperable Structures, Components, or Systems that Contributed to the Event:

None

C. Dates and Approximate Times of Major Occurrences:

July 27, 2002	12:28 PM CDT	Unit 2 generator trip, main turbine trip, and reactor scram occurred. Expected PCIS actuations occurred.
	12:35 PM CDT	The PCIS actuation logic was reset. The SGT and CREV systems were secured and normal reactor building ventilation re-established.
	12:40 PM CDT	Reactor protection system logic reset
	12:52 PM CDT	RWCU system returned to service.
	14:47 PM CDT	Required four-hour and eight-hour reports were made via telephone to the NRC Operations Center.

D. Other Systems or Secondary Functions Affected

None

E. Method of Discovery

This event was identified through numerous indications and alarms in the control room.

F. Operator Actions

This event was an uncomplicated scram. All operator actions taken in response to the scram and in the recovery from the event were appropriate. These actions included the verification that the reactor had been successfully shut down, the expected system isolations and initiations had occurred, and accomplishing the subsequent restoration of these systems to normal alignments.

G. Safety System Responses

All equipment operated in accordance with the plant design during this event.

The RPS logic responded to the turbine trip event per design to initiate the reactor scram. All control rods fully inserted into the core.

The PCIS logic responded per design to the expected lowered reactor water level by actuating the following isolation groups:

- Group 2 - Residual Heat Removal shutdown cooling function isolation (not in service at the time of the event)
- Group 3 - RWCU system isolation
- Group 6 - primary and secondary containment isolation, including the isolation of the normal reactor building ventilation and the initiation of the SGT and CREV systems
- Group 8 - withdrawal and isolation of the Traversing Incore Probes (the probes were not inserted at the time of this event)

Reactor water level was maintained by the condensate and feedwater systems and the normal water level control systems such that no automatic or manual operation of the HPCI or RCIC systems was required during this event.

The trip of the main turbine is accomplished by the rapid closure of its control and stop valves. This valve operation produces a pressurization transient in the main steam lines and reactor vessel upstream of the valves. Thirteen SRVs are installed on the main steam lines to mitigate such pressurization transients. Four valves lifted briefly during this event. The system pressure quickly lowered to the normal range through the combined effects of the SRV operation, the operation of the main turbine bypass valves, and the scram of the reactor. Each SRV properly reseated with the lowering pressure

III. CAUSE OF THE EVENT

A. Immediate Cause

The immediate cause of this event was the occurrence of a ground fault on a low-side bushing on main bank transformer 2A.

B. Root Cause

The root cause of this event was thermal degradation of the bushing internal condenser, resulting in the paper insulation reaching its end-of-life.

C. Contributing Factors

None

IV. ANALYSIS OF THE EVENT

This event was an uncomplicated plant scram. Both the temporarily lowered reactor water level and the temporarily raised reactor pressure conditions are expected plant responses to a turbine trip event. The event as it occurred is specifically addressed in the plant Final Safety Analysis Report (FSAR), and the plant conditions assumed in the FSAR for analyzing this event are more severe than the actual conditions which were in existence at the time of this event. See Section V. below for further details.

The electrical fault in the main bank transformer bushing created a ground path in the main generator output circuit. This ground condition was detected by the appropriate protective relaying, and the relaying circuitry acted to trip the main generator. The trip of the main generator resulted in a direct trip of the main turbine, and the main turbine trip, occurring from above approximately 30% reactor power, directly scrammed the reactor. All of these trip actions occurred in accordance with the plant design.

Equipment response following the turbine trip and reactor scram was also in accordance with the plant design. The short term pressurization transient was mitigated by SRV and turbine bypass valve operation, and pressure control following the initial transient was handled by the bypass valves. The operation of other systems post-scram (e.g., containment isolation, start up of SGT and CREV, isolation of normal reactor building ventilation, RWCU isolation, TIP isolation, etc.) also occurred in accordance with the plant design. The main condenser continued to function as the heat sink following the scram. All operator actions were appropriate.

V. ASSESSMENT OF SAFETY CONSEQUENCES

FSAR sections 14.5.2.1 and 14.5.2.2 specifically address the main generator trip event. Turbine bypass valves are assumed to function in the discussion under section 14.5.2.1. Section 14.5.2.2, however, assumes that the main turbine bypass valves do not function and therefore is the more limiting scenario. This analysis assumes initial conditions of all rods fully withdrawn, a core power of 100% of rated, and a core flow of 105% of rated. The analysis shows that no safety limits are exceeded for such a transient scenario. The transient event described in this LER was less severe than that described in the FSAR section 14.5.2.2 analysis, and this event is fully bounded by the analysis presented in section 14.5.2.2. The health and safety of the public was not affected by the subject scram event.

VI. CORRECTIVE ACTIONS

A. Immediate Corrective Actions

Following identification of the failed main transformer bushing, the site's spare main bank transformer was aligned for service on Unit 2. Unit 2 was then returned to power operation.

The failed bushing and the three other low-side bushings on main bank transformer 2A were replaced with new ones. After completion of post-maintenance testing, the 2A main bank transformer is now available for use on Unit 2. At the next convenient opportunity, the 2A transformer will be returned to service on Unit 2 and the site spare will be returned to standby status.

Site personnel initiated a periodic monitoring of the generator neutral ground resistor voltage to observe any indication of increasing ground current.

B. Corrective Actions to Prevent Recurrence[1]

All other main bank transformer low side bushings on Unit 2 and Unit 3 will be replaced with new ones at the next refueling outage.

TVA will re-evaluate the criteria used in determining bushing condenser replacement intervals, and the bushing maintenance practices will be revised accordingly.

[1] TVA does not consider these corrective actions as regulatory commitments. The completion of these actions will be tracked in TVA's Corrective Action Program.

NARRATIVE *(If more space is required, use additional copies of NRC Form 366A) (17)*

VII. ADDITIONAL INFORMATION

A. Failed Components

Main Bank Transformer low voltage bushing (ASEA GOH 150)

B. Previous LERs on Similar Events

None

C. Additional Information

None

D. Safety System Functional Failure Consideration:

This event does not involve a safety system functional failure which would be reported in accordance with NEI 99-02. The scram was caused by a malfunction of non-safety related equipment. All safety-related equipment performed in accordance with design in response to the event.

E. Loss of Normal Heat Removal Consideration:

The main condenser was retained as the heat sink during this event, and the feedwater system continued to provide reactor vessel inventory make-up. Neither HPCI nor RCIC operated during this event. A momentary lift of four SRV's occurred at the time of the event to control the initial pressure transient, but the valves properly reseated. Other than in quenching the discharge from the short-term opening of the SRV's, the suppression pool was not used as a heat sink following this event. This event does not constitute a scram with a loss of normal heat removal which would be reported in accordance with NEI 99-02.

VIII. COMMITMENTS

None